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(54) Title: POSITIVE-ELECTRODE ACTIVE MATERIAL FOR NON-AQUEOUS ELECTROLYTE SECONDARY CELL AND PROCESS FOR PREPARING THE SAME

(57) Abstract: A positive-electrode active material for non-aqueous electrolyte secondary cells which combine improved discharge property and operational safety, and a process for preparing the same are provided. The positive-electrode active material comprises a base and one or more layers for coating the base, wherein at least one of the layers is a coating layer comprising one or more metallic components and one or more components selected from the group consisting of sulfur, selenium, and tellurium.



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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 08 250120 A (SANYO ELECTRIC CO LTD) 27 September 1996 (1996-09-27) the whole document ---	1-13
X	EP 1 136 446 A (MERCK PATENT GMBH) 26 September 2001 (2001-09-26) * see p.3, line 58 and claims 2 * the whole document ---	1-13
X	EP 0 865 091 A (VARTA BATTERIE) 16 September 1998 (1998-09-16) * see col.1, l. 45-47, claim 1 * the whole document ---	1-13
X	US 5 139 901 A (KAWAGUCHI MASAYUKI ET AL) 18 August 1992 (1992-08-18) * see col. 2, l. 23-26 and claims 1- 6 * the whole document --- -/--	1-13

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PCT/EP 03/01939

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 836 238 A (FUJI PHOTO FILM CO LTD) 15 April 1998 (1998-04-15) * see p.5, line 56/57, claim 15 * the whole document ----	1-13
Y	JP 07 288127 A (FUJI PHOTO FILM CO LTD) 31 October 1995 (1995-10-31) the whole document ----	1-13
Y	WO 97 49136 A (WESTAIM TECHNOLOGIES INC) 24 December 1997 (1997-12-24) cited in the application * see claims * the whole document ----	1-13
Y	CHO J ET AL: "IMPROVEMENT OF STRUCTURAL STABILITY OF LIMN2O4 CATHODE MATERIAL ON 55 DEG C CYCLING BY SOL-GEL COATING OF LICOO2" ELECTROCHEMICAL AND SOLID-STATE LETTERS, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 2, no. 12, 1999, pages 607-609, XP009018016 ISSN: 1099-0062 * see p. 607, abstract * the whole document ----	1-13
Y	CHO J ET AL: "ENHANCEMENT OF THERMAL STABILITY OF LICOO2 BY LIMN2O4 COATING" ELECTROCHEMICAL AND SOLID-STATE LETTERS, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 2, no. 6, June 1999 (1999-06), pages 253-255, XP000864960 ISSN: 1099-0062 the whole document -----	1-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 03/01939

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 08250120	A	27-09-1996	NONE	
EP 1136446	A	26-09-2001	DE 10014884 A1 BR 0101026 A CA 2342077 A1 CN 1319905 A EP 1136446 A2 JP 2001313034 A US 2001046628 A1	27-09-2001 06-11-2001 24-09-2001 31-10-2001 26-09-2001 09-11-2001 29-11-2001
EP 0865091	A	16-09-1998	DE 19709783 A1 CA 2231482 A1 CN 1197301 A EP 0865091 A2 JP 10255850 A US 6103416 A	17-09-1998 10-09-1998 28-10-1998 16-09-1998 25-09-1998 15-08-2000
US 5139901	A	18-08-1992	JP 2101296 C JP 3165463 A JP 8017094 B	22-10-1996 17-07-1991 21-02-1996
EP 0836238	A	15-04-1998	AU 6242496 A EP 0836238 A1 US 2002114993 A1 US 6365299 B1 WO 9701870 A1	30-01-1997 15-04-1998 22-08-2002 02-04-2002 16-01-1997
JP 07288127	A	31-10-1995	NONE	
WO 9749136	A	24-12-1997	AU 2947597 A CA 2257985 A1 WO 9749136 A1 EP 0907975 A1 JP 2000515300 T KR 2000016626 A TW 420887 B ZA 9705156 A	07-01-1998 24-12-1997 24-12-1997 14-04-1999 14-11-2000 25-03-2000 01-02-2001 15-12-1997